大葉大學 九十二 學年度 研究所碩士班 招生考試試題紙

系 所 別	組 別	考 試 科 目 (中 文 名 稱)	考 試 日 期	節 次	備 註
電機工程學系	甲組	固態電子學	4 月 13 日	第 三 節 13:30～15:00	可使用不可程式計算機 (本試題共一頁)

註：答題應詳列計算步驟,否則一概不予計分

1. (a)Determine the position of the Fermi level with respect to the intrinsic Fermi level in silicon at T=300K that is doped with phosphorus atoms at a concentration of $10^{15}cm^{-3}$.(10%) (b)Repeat part (a) if the silicon is doped with boron atoms at a concentration of $10^{15}cm^{-3}$.(10%) (c)Calculate the electron concentration in the silicon for parts (a) and (b).(10%) [The intrinsic concentration n_i of Si sample at 300K is $1.5x10^{10}cm^{-3}$]

2. Please describe in details the two major physical mechanisms giving rise to the reversed –bias breakdown in a p-n junction semiconductors.(15%)

3. Sketch the band diagram of the p-n junction including E_c,E_v,E_{Fp} and E_{Fn} for (a)thermal equilibrium (b) forward- bias and (c) reverse- bias (15%)

4. To determine the electric field in a semiconductor in thermal equilibrium. Assume that the donor concentration in an n-type semiconductor at T=300K is given by $Nd(x)=10^{16}-10^{19}x$ (cm^{-3}), where x is given in μm and ranges between $0 \leqq x \leqq 1$ μm (10%)

5. Assume a silicon p^+n junction at T=300K with $n_i=1.5X10^{10}cm^{-3}$ and $1/C^2$-V curve for C-V measurement is shown in Figure 1.Please determine the concentrations of p^+ and n region. Assume the permittivity of the silicon is $\varepsilon=11.7x8.85x10^{-14}$F/cm (10%)

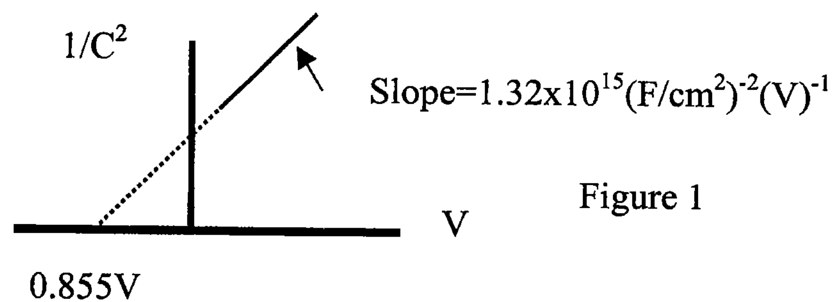

Figure 1

6. Compare the difference of the Schottky and Ohmic contacts by I-V characteristics for metal-semiconductor contact system. (10%)

7. Explain the following (a)emitter current-crowding effect for BJT (b)channel length modulation for MOSFET. (10%)